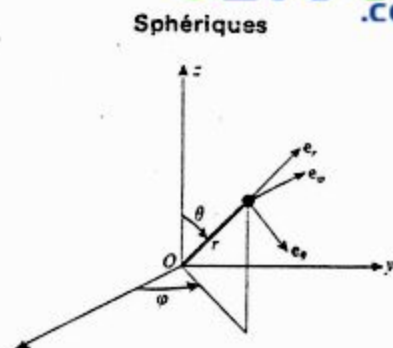
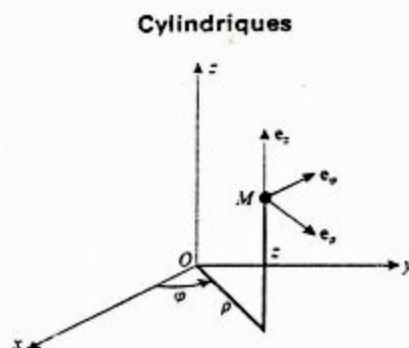
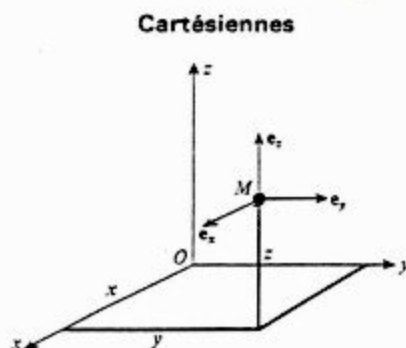


Systèmes de coordonnées



DEFINITIONS	$U = U(x, y, z)$ $\mathbf{A} = A_x \mathbf{e}_x + A_y \mathbf{e}_y + A_z \mathbf{e}_z$ $A_x = A_x(x, y, z)$ $A_y = A_y(x, y, z)$ $A_z = A_z(x, y, z)$	$U = U(\rho, \varphi, z)$ $\mathbf{A} = A_\rho \mathbf{e}_\rho + A_\varphi \mathbf{e}_\varphi + A_z \mathbf{e}_z$ $A_\rho = A_x \cos \varphi + A_y \sin \varphi$ $A_\varphi = -A_x \sin \varphi + A_y \cos \varphi$	$U = U(r, \theta, \varphi)$ $\mathbf{A} = A_r \mathbf{e}_r + A_\theta \mathbf{e}_\theta + A_\varphi \mathbf{e}_\varphi$ $A_r = A_x \sin \theta + A_z \cos \theta$ $A_\theta = A_x \cos \theta - A_z \sin \theta$ $A_\varphi = -A_x \sin \varphi + A_y \cos \varphi$
GRADIENT	$\nabla U = (\partial U / \partial x) \mathbf{e}_x + (\partial U / \partial y) \mathbf{e}_y + (\partial U / \partial z) \mathbf{e}_z$	$(\nabla U)_\rho = \partial U / \partial \rho$ $(\nabla U)_\varphi = [\partial U / \partial \varphi] / \rho$ $(\nabla U)_z = \partial U / \partial z$	$(\nabla U)_r = \partial U / \partial r$ $(\nabla U)_\theta = [\partial U / \partial \theta] / r$ $(\nabla U)_\varphi = [\partial U / \partial \varphi] / (r \sin \theta)$
LAPLACIEN	$\Delta U = \frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 U}{\partial y^2} + \frac{\partial^2 U}{\partial z^2}$	$\Delta U = \frac{1}{\rho} \frac{\partial}{\partial \rho} \left(\rho \frac{\partial U}{\partial \rho} \right) + \frac{1}{\rho^2} \frac{\partial^2 U}{\partial \varphi^2} + \frac{\partial^2 U}{\partial z^2}$	$\Delta U = \frac{1}{r} \frac{\partial^2}{\partial r^2} (rU) + \frac{1}{r^2 \sin \theta} \frac{\partial}{\partial \theta} \left(\sin \theta \frac{\partial U}{\partial \theta} \right) + \frac{1}{r^2 \sin^2 \theta} \frac{\partial^2 U}{\partial \varphi^2}$
DIVERGENCE	$\nabla \cdot \mathbf{A} = \frac{\partial A_x}{\partial x} + \frac{\partial A_y}{\partial y} + \frac{\partial A_z}{\partial z}$	$\nabla \cdot \mathbf{A} = \frac{1}{\rho} \frac{\partial}{\partial \rho} (\rho A_\rho) + \frac{1}{\rho} \frac{\partial A_\varphi}{\partial \varphi} + \frac{\partial A_z}{\partial z}$	$\nabla \cdot \mathbf{A} = \frac{1}{r^2} \frac{\partial}{\partial r} (r^2 A_r) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \theta} (\sin \theta A_\theta) + \frac{1}{r \sin \theta} \frac{\partial A_\varphi}{\partial \varphi}$
ROTA-TIONNEL	$\nabla \wedge \mathbf{A} = (\partial A_z / \partial y - \partial A_y / \partial z) \mathbf{e}_x + (\partial A_x / \partial z - \partial A_z / \partial x) \mathbf{e}_y + (\partial A_y / \partial x - \partial A_x / \partial y) \mathbf{e}_z$	$(\nabla \times \mathbf{A})_\rho = (\partial A_z / \partial \varphi) \rho - \partial A_\varphi / \partial z$ $(\nabla \times \mathbf{A})_\varphi = \partial A_\rho / \partial z - \partial A_z / \partial \rho$ $(\nabla \times \mathbf{A})_z = [\partial (\rho A_\varphi) / \partial \rho - \partial A_\rho / \partial \varphi] \rho$	$(\nabla \times \mathbf{A})_r = [\partial (\sin \theta A_\varphi) / \partial \theta - \partial A_\theta / \partial \varphi] / (r \sin \theta)$ $(\nabla \times \mathbf{A})_\theta = [\partial A_\varphi / \partial \varphi - \sin \theta \partial (r A_\rho / \partial r)] / (r \sin \theta)$ $(\nabla \times \mathbf{A})_\varphi = [\partial (r A_\theta) / \partial r - \partial A_r / \partial \theta] / r$



et encore plus..